



## **Request for N - STEPS Support**

### **I. Contact Information**

#### EPA Regional Contact Information

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\*If a cross - regional effort, please provide other regional contact information:



## II. Project Information

Proposed Project Type (check all that apply)

Preliminary N - STEPS staff review and feedback on:

☐ Draft analysis

☒ Draft criteria document review

☐ Literature review

☒ Independent scientific peer review (please indicate the preferred number of reviewers)

☐ Data analysis and presentation

☐ Workshop/Training

Proposed Project Description Project timeframe: Review of Enhancements made to a Mechanistic Model Used by Montana DEQ to Derive Numeric Nutrient Criteria for the Upper-Middle Yellowstone River.

Estimated level of effort and cost: 40 hrs \* 2/3 reviewers = ~ 5,000 (Steph, what were the costs of other reviews?)

Applicable State(s): Montana

Waterbody type(s): Upper-Middle Segment of the Yellowstone River

Parameter(s): TN/TP

Does State have a mutually - agreed upon nutrient criteria plan?

Y ☒ N ☐

Has the State submitted milestone dates for the associated WQ PAM?

Y ☒ N ☐

Is the project associated with milestones in the State's mutually - agreed upon nutrient criteria plan?

Y ☐ N ☒

If yes, please provide a description of the associated milestone with a reference to the plan language.

If no, please describe how the project supports the State's efforts to adopt numeric nutrient criteria.

In February 2015, EPA approved Montana's numeric nutrient criteria for Wadeable streams and for specific segments of the Yellowstone River. The state plans to use models to derive numeric nutrient criteria for other non-Wadeable rivers, including some remaining sections of the Yellowstone and the mainstem Missouri River. Montana DEQ (MDEQ) is finalizing their technical rationale and proposed numeric nutrient criteria for the upper and middle sections of the Yellowstone River, which extends approximately half of the river's length in Montana. Once the technical review is completed, MDEQ intends to adopt the numeric criteria during their upcoming triennial review, which means MDEQ will want to present their recommended criteria to the Montana Board of Environmental Review by July 2016.

### Project Summary:

MDEQ is requesting an independent peer review of the scientific rationale for specific aspects of their modelling approach on the Upper-Middle segment of the Yellowstone River (from upstream of Livingston, MT to the confluence with the Bighorn River). The reach includes the city of Billings, the largest city in Montana and the location of many NPDES permits which will be affected by the criteria. While EPA approved the model-derived TN/TP criteria for the lower segment of the Yellowstone River (approximately one-half of the Yellowstone River's extent across the state), the state has since made

several adjustments to one of the mechanistic models being used for this segment of the Yellowstone. Changes have been made to the AT2K<sup>1</sup> model, the companion model to QUAL2K. AT2K models attached (benthic) algae growth across a channel (i.e., from bank to bank), allowing much more detailed evaluation of excess algae effects on different parts of the river (e.g., shallow zones vs. deep zones). Specifically, MDEQ did the following to the model:

1. Incorporated a velocity effect term into AT2K's governing equations to control mass-transfer at low velocities and to increase algal sloughing at higher velocities. The modified model is being submitted for peer-review at this time since it has not yet been applied to derive TN/TP criteria.
2. Modified the model to accommodate two algal assemblages (filamentous algae and diatom algae) which were observed at multiple locations in the river and which showed spatial preference for different habitat types. This change will much more accurately represent the actual manner in which attached algae manifest in this river as well as many other northern temperate rivers.

The reviewers are being asked to evaluate the validity of the equations and techniques that have been used to model cross-section velocity profiles. They will also be asked to evaluate the mechanisms used to control the growth and ultimate biomass of the two major algal groups being addressed (diatom-like algae closely adhering to bottom substrate, and filamentous algae). MDEQ's basic question is, is this a defensible approach?

First time request?

Y ☒ N ☐

If not, please provide details of previous request(s):

Date of request(s):

Associated with previous N - STEPS support?

Y ☒ N ☐

If yes, please provide details of associated work:

MDEQ requested peer review of its overall modeling approach to deriving numeric nutrient criteria for large rivers (field data collection, model calibration, validation, endpoint selection, etc.) in late 2011. In October 2012 MTDEQ provided its response to the peer review comments and the final technical document, model, and criteria (and adopted nutrient standards) reflect the responses to those comments.

To be clear, MDEQ is not requesting another overall review of the same basic methods it has already applied to a large river. Rather, MDEQ is requesting scientific review of the specific modifications it has made to one of the key models (AT2K) it uses to derive numeric nutrient criteria for large rivers. These changes alter how MDEQ models algal growth, and will therefore have an effect on the model endpoints and how they are evaluated.

Date of request(s):

N - STEPS project period of performance (approximate): March –May 2016

Brief description of associated work:

Using NSTEPS support, an independent peer review will be conducted that will examine the model theory and assumptions, model performance in several case studies, and implications on the draft TN/TP criteria.

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<sup>1</sup> See Flynn, K.F., S.C. Chapra, and M.W. Suplee, 2013. Modeling the Lateral Variation of Bottom-attached Algae in Rivers. Ecological Modelling 267: 11-25.



Applicable State(s): Montana



### III. Cost - share Information (if applicable)

Is the Region(s) providing funding support?

Y ☐ N ☒

If yes, what degree of support?

Please provide procurement information to N - STEPS Program Manager after EHPB approval.